ASTR 288C – Lecture 10

Tuesday, 9 November 2009

Presenting Information

Science Writing

Introduction

Science (from the Latin *scientia*, or knowledge) is the field of study that attempts to describe and understand the nature of the universe in whole or in part. Such knowledge has to be shared with your peers to advance the field, and also need to be communicated to the general public who funds your work and has a right to be informed. The public is usually very interested in astronomy. We, as astronomers, enjoy a somewhat special position in that the public is willing to fund us to do research that does not directly affect their lives, and in many cases may never lead to practical applications. It is important to be able to keep the public informed about astronomical research so that they continue to support out work.

Science needs to be reproducible to be generally accepted. Therefore, scientific writing is at the core of science. Scientific journals communicate and document the results of scientific research (usually carried out at universities or research institutions), and serve as an archival record of science.

An enormous amount of literature is being published every year (week, day). In astronomy and astrophysics alone, 25,000 papers were published in the first quarter of 2009.

From Draft to Print

In astronomy and astrophysics, most scientific research is published in refereed scientific journals, such as *The Astrophysical Journal*, *The Astronomical Journal*, *Astronomy & Astrophysics*, *Monthly Notices of the Royal Astronomical Society*, *Publications of the Astronomical Society of the Pacific*, and in more general science journals such as *Science* and *Nature*. Each of the journals has its own style typesetting, and most require that LaTeX be used when preparing articles (see Lecture 3). It is important to follow the required style for each journal to ensure prompt publication of your articles.

When you think that you have a result that is worthy of a paper, you first need to *decide what journal to select*. Individual journals tend to emphasize different types of articles. For example, *Science* and *Nature* generally only print significant new results that they deem to be news-worthy, or of interest outside the astrophysics community. *The Astronomical Journal* tends to stress observational results while *The Astrophysical Journal* is often used to publish theoretical results. If in doubt contact the editor of the journal that you are considering and ask if your article is appropriate for that journal. Once you have picked a journal, you need to select the form of communication, i.e., a Letter, an Article, a Supplementary Article,

or a Review Article. Letters are short (usually four pages or less) articles that are intended for results that need to be communicated quickly. Articles are the most common form of publication. They can be any length, subject to the journal's policies, and are intended to be written in sufficient depth that they provide a complete description of the research and can stand alone. In some cases articles are published as part of a series that describes on-going research or different aspects of a large research project. Supplementary Articles are intended for publishing catalogues, large date sets, or other detailed information that needs to be archived for posterity, but is not appropriate for a regular article. Review Articles are usually invited articles that summarize the state of a particular field of astronomy.

When you have decided what and where to publish you then start drafting your paper, usually using the LaTex typesetting software and the style file that the journal provides. Some journals accept MS Word articles. Always check with the journal *before* starting to write your paper to be sure that you are preparing it in a way that is consistent with their requirements. Start by making a first draft of the paper (don't worry about formatting at this stage) that outlines what you will present in the paper, and include some preliminary figures. The first draft is a detailed outline that you will fill out as the paper progresses. Send this first draft of the paper to your co-authors and ask them if they think that this paper is headed into the right direction. Once you team has agreed to the contents of the paper, start drafting the individual sections. In astronomy and astrophysics, the sections of a paper are usually those listed below. Only sections that are needed should be included, and they can be named whatever is appropriate as long as the name clearly communicates what is in that section

- **Title**: Chose a title that describes your study in as few words as possible. Try to avoid the temptation to use in jokes or humour. What is funny to you may not be funny to your readers

- **Name of authors**: The order of the authors should reflect their contributions to the study. There are several ways of doing this, and different research teams usually develop their own policies. Alternate methods are to list the person who wrote most of the paper first, and then list the co-authors in alphabetical order. Another method is to roll the dice.

- **Abstract**: The abstract should summarize concisely the contents and conclusions of the paper. It is usually a single paragraph of no more than 300 words and should not contain reference citations, although see the journal's style guide for detailed instructions. Make sure that the title and abstract grab the reader's attentions. With approximately 50 papers appearing on the astro/ph abstract server each day, you have to make sure that potential readers understand what your paper is all about, and if it is interesting to read the paper in full. Often people never read beyond the abstract, so it should be sufficient to let people know what your paper is about.

- **Subject Keywords**: Keywords are being used to index your paper electronically. See the journal's instructions to the author for the rules on selecting keywords. Each journal does this differently.

- **Introduction**: Give a historic introduction to the topic that puts your study into context. However, don't spend too much space on this. Cite and give reference to all most important papers in this field so readers can read more about it. The Introduction should contain enough information that a person who is not an expert on that research topic can understand the rest of your paper.

- **Data Analysis:** If your study uses data and observations, describe the data here (e.g., what instrument and mode, when and how the observations were performed), followed by a subsection about the data calibration and analysis steps that were performed. This section should contain all the information that is needed for someone to reproduce your analysis.

- **Results:** Describe the results of your data analysis. Don't confuse the results of your study with your interpretation of the results. Give the facts here, e.g., brightness of objects, timing characteristics, or the spectral properties. In some cases the Results can be summarized in a table, or series of tables. Figures can be useful for describing your results.

- **Discussion:** This is the most creative part of your paper where you discuss what you learned from the analysis of the data, how the data compare to models, and your expectations. Are there surprises or is everything as expected from theoretical predictions? Compare your results with other studies in this area. This is the primary part of the paper where you can interpret the data.

- **Summary:** Briefly summarize the implications of your study, what the key results are, and what you have learned. Be brief. The Summary should be only a few paragraphs. Keep in mind that most readers will first read the title of your paper. If they are intrigued, they will read the Abstract. If they are very interested, they will jump to the Summary. Only if someone works on similar or related observation, they will read the rest of the paper. Note that the summary is *not* the abstract.

- **References:** Each scientific paper needs to be fully referenced through citations. Everything that you claim as a fact but is not evident as such from your data and analysis needs to be referenced. This means *every* single detail! Make sure that you reference all papers that are relevant to your study. Do not play political games here and ignore your competitors as this will backfire. Try to "sneak in" as many citations to your own papers if —and only if—they are related to this study to enhance the visibility of your papers.

- **Acknowledgements:** Make sure that you acknowledge all grants that were used in this study, give special credit to people who have helped you through discussions. Acknowledge instruments, facilities, and services that you have used (e.g., telescopes, data centers, databases for literature search, etc.). Note that some facilities require the use of boilerplate text (e.g., "This facility made use of VLA data…") in te Acknowledgements.

- **Supplementary information:** Some journals allow you to put detailed information about the data and analysis into a supplement. This is usually available either as link to a Web site, or at the end of your paper. Very few people will read this supplementary information, but it might be crucial in saving space for the actual paper and making it more readable, while still presenting all relevant information. Example: long data tables or complicated data analysis techniques are often found in the supplements.

- **Tables:** Your paper should have a set of tables that provide all information at a glance. Examples: You can list all the observations in a table, or list the spectral properties of your source, along with best fits to models. Tables are a good way to summarize information, and are often easier for readers to understand than discussions in the text.

- **Figures:** Visualize your data in the best way possible. If possible, create all the plots and images in black and white and only use color if you present so much information that black and white cannot show the rich detail of the data (e.g., images obtained in different wavengths, images with contours overlaid, plots with more than three data sets, etc.). If you give an image, make sure that you include either a scale bar or a coordinate grid, otherwise the image will be useless. If you have multiple images of the same objects, draw images to the same scale. The image caption would clearly describe what is given in the figure. Figures are a very important part of any paper. It is true that a picture is worth a thousand words.

After a few iterations of writing and comments from your co-authors your paper should be ready for submission to a journal. When this happens a reviewer will be assigned to the paper by the scientific editor of the journal and it will be reviewed by peer(s). This peer review process is fundamental in science as it ensures a high quality of published papers and protects against fraud. The peer review process usually takes a few weeks. After receipt of the (anonymous) referee report, you need to revise the paper based on the review. If you disagree with part of the review you need to write an explanation of why you disagree. Your revised paper, and any comments that you have on the review, will be send to the reviewer. The reviewer can then either accept or reject the revised paper. In some cases the review may request additional changes. Be polite and co-operative with the reviewer, no matter how difficult that may be. Once the review process is over the paper goes to the scientific editor of the journal who makes the final decision about publication.

Some Dos and Don'ts about Writing Papers

- You do not have to try to impress people by using words most people have never heard of. Keep it simple, easy and simple to understand.

- Do not use colloquial speech, slang, or childish words or phrases. Use a professional vocabulary instead. Try to avoid jargon.

- Do not use contractions: for example, "don't" must be "do not", "isn't" must be "is not".

- Do not repeat. Repeating things does not make them better of more valid.

- Abbreviations**:** Using abbreviations is fine, but the first time you use them, they must be spelled out. Example: "We used the *X*-Ray Telescope (XRT)… With XRT we measured… "

- Use the *past tense* to report your and others' results. Research papers reflect work that has been completed, therefore use the past tense throughout your paper (including the Introduction) when referring to the actual work that you did. Use the *present tense* to discuss your results.

- First vs. Third Person: Astronomy has moved away from a very strict adherence to the third person construction, and now permits limited use of the first person in published papers. Limit your use of first person construction (i.e., " *I (or we) undertook this study*….). Usually it is most acceptable in the Introduction and Discussion sections, and then only to a limited extent. Use first person in the methods section sparingly if at all, and avoid its use in the results. By choosing the first person, you take personal responsibility.

- Use Active Verbs: Use active verbs whenever possible; writing that overly uses passive verbs (is, was, has, have, had) can be boring to read and almost always results in more words than necessary to say the same thing.

  ACTIVE: "*the black hole consumes material at a higher rate*..."
  PASSIVE: "*material is consumed by the black hole at a higher rate*.."

  ACTIVE: "*Smith et al. reported* ..."
  PASSIVE: "*It was reported by Smith et al.* …"

  The clarity and effectiveness of your writing will improve dramatically as you increase the use of the active voice.

- Use short words.
  possess → have

sufficient → enough
utilize → use
demonstrate → show
assistance → help
terminate → end

- Use short sentences.

- Use concise terms.
  prior to → before
  due to the fact that → because
  in a considerable number of cases → often
  the vast majority of → most
  during the time that → when
  in close proximity to → near
  it has long been known that → I'm too lazy to look this up

- Do not, use, unnecessary, commas.

- Plagiarism: Since most papers are posted on the astro-ph abstract server in its original form (i.e., LaTeX, Word), it is easy to copy and paste part of text, figures, etc. *Never* copy anything from someone else's paper! If you discuss someone's idea, quote their paper. If you discuss something with a colleague and no paper is available, include in your bibliography "Name, YYYY private communication". Plagiarism can end your career in an afternoon.

- Last, but not least: Use a *spell checker*, and use the "learn" feature of your spell checker for the scientific terms (but be careful not to add a misspelt word).

- *Proofread* again & again & again.

Science Talks

- Speak loud and clearly, not in a soft monotone.
- Vary the pitch of your voice (monotones are sleep-inducing).
- Speak from the gut, not the throat, and use the bottom of your vocal range.
- It is better to speak too loud than too soft.
- Breath! (No joking, many speakers forget to breath).
- Don't read, talk. Do not read a prepared text, but do use notes.
- Face the audience and do not look at the screen behind you. Make eye contact.
- Stand (do not sit) offset from the screen so the audience can see the slides.
- Move a little (don't just stand there) but don't move too much.
- Don't be afraid and try not to be nervous. *You* are the expert.
- Don't get lost in complicated details. Just explain the main results in sufficient detail and focus on what message you want to get across.
- Try to read the audience's response, look at their faces for reaction, and make eye contact.
- Have visuals to illustrate what you are saying. If you present images or plots, explain what you see.
- If using PowerPoint or Keynote, *keep it simple* (stars don't have to twinkle).
- Always have a back-up copy of your talk on a memory stick. It is a good idea to have a second back-up in a different file format. PDF is a good choice because almost all computers have the ability to display a PDF file. If you are travelling e-mail a copy of your talk to yourself in case your computer gets lost or broken
- Keep track of time and *practice your talk*. You don't want to run out of time before you present the conclusions!
- Try to anticipate questions and have supplemental slides.
- Decide ahead of time what slides you could skip if you run out of time.

- Giving a talk can be intimidating but also a lot of fun! Relax. You know more about what you are talking about than your audience does. Remember, *you are the expert, you know more than your audience does,* and *the person asking the question is probably wrong.*

How to Give a Bad Talk

by David A. Patterson
Computer Science Division University of California-Berkeley

Circa 1983

Ten Commandments

I. **Thou shalt not be neat.** Why waste research time preparing slides? Ignore spelling, grammar and legibility. Who cares what 50 people think?

II. **Thou shalt not waste space.** Transparencies are expensive. If you can save five slides in each of four talks per year, you save $7.00/year!

III. **Thou shalt not covet brevity.** Do you want to continue the stereotype that scientists can't write? Always use complete sentences, never just key words. If possible, use whole paragraphs and read every word.

IV. **Thou shalt cover thy naked slides.** You need the suspense! Overlays are too flashy.

V. **Thou shalt not write large.** Be humble—use a small font. Important people sit in front. Who cares about the riff-raff?

VI. **Thou shalt not use color.** Flagrant use of color indicates careless research. It is also unfair to emphasize some words over others.

VII. **Thou shalt not illustrate.** Confucius says "*A picture = 10k words*", but Dijkstra says "*Pictures are for weak minds.*" Who are you going to believe: wisdom from the ages or the person who first counted "go to" statements?

VIII. **Thou shalt not make eye contact.** You should avert eyes to show respect. Blocking screen can also add mystery.

IX. **Thou shalt not skip slides in a long talk.** You prepared the slides; people came for your whole talk; so just talk faster. Skip your summary and conclusions if necessary.

X. **Thou shalt not practice.** Why waste research time practicing a talk? It could take several hours out of your two years of research. How can you appear spontaneous if you practice? If you do practice, argue with any suggestions you get and make sure your talk is longer than the time you have to present it.

Commandment X is most important. *Even if you break the other nine, this one can save you.*